

1                   **"AMMUNITION HAVING SURFACE INDICIA AND METHOD OF**  
2                                           **MANUFACTURE"**  
3

4                   CROSS REFERENCE TO RELATED APPLICATION

5                   This application claims priority of US Provisional application  
6                   60/440,375, filed January 16, 2003, the entirety of which is incorporated herein  
7                   by reference.  
8

9                   FIELD OF THE INVENTION

10                  The present invention relates to ammunition and more particularly  
11                  to camouflaged shotshells used in waterfowl hunting and methods of  
12                  manufacture.

13                  BACKGROUND OF THE INVENTION

14                  The sport of waterfowl hunting is a highly popular sport throughout  
15                  North America with hundreds of millions of dollars being spent on equipment,  
16                  permits and ammunition each year.

17                  One problem faced by all waterfowl hunters is that of glare. Glare  
18                  from equipment, clothing, glasses and ammunition is sufficient to alert and alter  
19                  the course of waterfowl, keeping them out of the range of hunters.

20                  One cannot underestimate the degree to which hunters will go to  
21                  ensure that glare is reduced. One solution employed in almost all hunting  
22                  equipment today is the use of camouflage to reduce glare. Clothing, gun stocks  
23                  and barrels, face masks, duck and goose calls and blinds are all disguised with a

1 variety of camouflage patterns. The use of non-reflective decoys adds to further  
2 glare reduction.

3           Ammunition used in shotguns for waterfowl hunting is a shotshell.  
4 The shotshell has a brass hull and a polyethylene or paper case which fits into  
5 the hull. A primer is seated in the hull and a powder charge is placed into the hull.  
6 A wad is placed over the powder and a load of shot is then added to the case.  
7 The open end of the case is then sealed either by crimping or by a plastic disc  
8 placed inside a rim at the top end of the case. Optionally, a top wad may be  
9 placed over the shot before the case is closed.

10           Typically, manufacturers make the cases of the shotshell using  
11 brightly colored plastics and the brass hull is left exposed, both of which add to  
12 the shells visibility and glare. This is especially a problem when hunters shoot  
13 multiple shells each time a flock of birds flies over and the shells accumulate on  
14 the ground. There may be little time between successive flights of birds to  
15 attempt to both pick up birds which have been killed and pick up spent shell  
16 casings, which are ejected several feet away from a hunting blind. More effort is  
17 made to collect the birds and therefore the shell casing are likely to amass in  
18 large quantities around each hunting blind.

19           Many of the shotshell cases are slightly corrugated providing a non-  
20 smooth surface and the polyethylene used to make most modern cases has a  
21 natural greasiness which resists printing with many inks or paints. Both of these  
22 features result in a poor surface on which to print any type of patterns or non-  
23 reflective coating.

1           US Patent 4,384,518 to Albin and owned by Remington Arms  
2 Company Inc., describes a dry offset printer for cylindrical objects and particularly  
3 for use in printing onto shotshell cases. The process utilizes a three-roller system  
4 which includes ink, plate and blanket rolls, the blanket roller being a relatively soft  
5 elastomeric for printing onto corrugated shell cases. Applicant has noted that  
6 shells cases which are currently printed with manufacturer or distributor  
7 information are prone to loss or flaking of the printing off of the shell case as  
8 shotshells are carried in ammunition belts or loaded into guns.

9           Tolerances within the gun breach must be considered when adding  
10 any additional matter to the diameter of a shotshell, to prevent jamming during  
11 discharge of the gun and potential injury to the hunter.

12           Shotshells can be loaded manually or can be assembled in a highly  
13 automated process. Shotshells are produced in a plurality of lengths and also in  
14 a plurality of gauges. Because of the explosive nature of the product, the  
15 automated process must meet stringent safety requirements and must also meet  
16 rigid quality control standards due to a narrow range of acceptable size  
17 tolerances. Current printing processes are typically integrated into the automated  
18 process. Any process for providing indicia on the surface of the shotshell should  
19 be capable of full integration into an assembly line-type manufacture process and  
20 should not alter the effective diameter significantly to prevent jamming during  
21 discharge.

22           In some cases it may be advantageous to provide additional  
23 waterproofing or water resistance to the shotshell to ensure that the powder and

1 primer remain active when in use especially in a highly aqueous environment  
2 such as found in natural wetlands. Shotshells will not properly fit into the breach  
3 of the shotgun if swelling occurs as a result of water penetration.

4               Significant efforts have been made by shotshell manufacturers to  
5 create water resistant shot wads as well as crimping techniques or seals at the  
6 open end of the case after loading of the shot and optionally, a water resistant or  
7 waterproof top wad. In some cases leakage into the shell case remains a  
8 problem. Further, compounds used to coat a shotshell after production are often  
9 messy or sticky to handle and may add irregularly to the diameter of the shotshell  
10 case causing problems with tolerances in the gun breach.

11              There is clearly a need to provide a shotshell that does not glare  
12 and more preferably that is camouflaged to suit a hunting environment so as not  
13 to be noticed by waterfowl within range of the hunter. Preferably, the shotshell  
14 should be water resistant if not waterproof for use in wetland situations or in  
15 inclement weather.

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## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of a prior art shotshell illustrating a hull and a case of the shotshell;

Figure 2 is a side view of a shotshell according to Fig. 1 having camouflage indicia printed on the external surface of the shotshell according to one embodiment of the present invention;

Figure 3 is a bottom perspective view of a shell according to Fig. 2, the bottom of the shotshell having been sprayed with a non-glare ink;

Figure 4 is a fanciful illustration of a shotshell of the present invention camouflaged in a hunting environment;

Figures 5a – 5b are flowcharts illustrating the incorporation of one embodiment of a printing process into a shotshell manufacturing assembly line, more particularly,

Figure 5a illustrates printing cases and hulls prior to assembly and loading, and

Figure 5b illustrates cases and hulls assembled prior to printing and alternatively loaded prior to or following printing of the assembled cases and hulls;

Figure 6 is a flowchart illustrating an embodiment of the printing process according to Fig. 5b using a plurality of inkjet print heads, UV curable ink or solvent-based ink and a conveyor for conveying unload, assembled shotshell hulls and casings for printing and particularly to inkjet print a camouflage pattern on substantially the entire exterior of the shotshell;

1                   Figure 7 is a schematic of an embodiment of apparatus operable to  
2 perform the printing process according to Fig. 6;

3                   Figure 8 is a partial perspective view according to Fig. 7, illustrating  
4 a pair of rotating belts for rotating shotshells carried by rotatable spindles as they  
5 pass adjacent a plurality of inkjet print heads for printing the entire surface of the  
6 shotshell, the print heads, seen in Fig. 7, having been removed to better view the  
7 rotating belt detail;

8                   Figure 9 is a schematic plan view of the apparatus according to Fig.  
9 7;

10                  Figure 10a is a plan view of an alternate embodiment operable to  
11 perform the printing process according to Fig. 6, the conveyor having a rack  
12 adjacent the print heads and geared rotatable pinions having spindles for  
13 engaging the rack and rotating the shotshells at the print heads;

14                  Figure 10b is a detailed plan view illustrating the engagement of the  
15 geared rotatable pinions with the rack

16                  Figure 10c is a side view according to Fig. 10a;

17                  Figure 11 is a flow chart illustrating an alternate embodiment of the  
18 invention in which heat transfer sleeves are pre-printed with indicia, using inkjet  
19 print heads, and subsequently heated onto shotshells for imparting indicia  
20 thereon; and

21                  Figures 12a-12c are perspective views of an alternate printing  
22 process embodiment, more particularly

1                    Figure 12a is a perspective view of a preprinted heat transfer  
2 sleeve being positioned over a shotshell;

3                    Figure 12b is a perspective view according to Fig. 12a wherein the  
4 heat transfer sleeve has being positioned for bonding to the shotshell; and

5                    Figure 12c is a perspective view according to Fig. 12b wherein the  
6 heat transfer sleeve has been bonded to the shotshell.

## SUMMARY OF THE INVENTION

In one aspect of the invention, camouflaged ammunition is produced by the application of indicia to substantially the entire outer surface of the ammunition. In the case of shotshells used for waterfowl hunting, a non-reflective camouflage indicia renders the ammunition substantially invisible to the waterfowl. Preferably the indicia resembles the environment in which the ammunition is to be used, such as but not limited to, a stubble field, a wetland marsh or prairie grass. The indicia acts to disrupt the outline of the ammunition on the ground making it difficult to see and preferably reduces glare therefrom.

In a broad aspect of the invention, ammunition having a substantially cylindrical outer surface comprises indicia applied to substantially the entire outer surface of the ammunition.

More particularly, the indicia is a non-reflective camouflage pattern which covers substantially the entire outer surface of the ammunition, any remaining outer surface, such as a metal hull or a portion thereof, being covered with a non-glare ink.

The indicia is either applied directly to substantially the external surface of cylindrical ammunition using an inkjet printing process or by applying the indicia to a heat transfer sleeve which is then applied to the ammunition using conventional heat transfer apparatus. The ammunition is first provided and oriented about its axis and then the indicia is applied to substantially the entire outer surface. The application of the indicia can be incorporated into the process of manufacturing the ammunition or it can be done after manufacture, such as to

1 pre-manufactured ammunition. When incorporated into a manufacturing process,  
2 the indicia can be applied separately to cases and hulls in the case of  
3 ammunition such as shotshells or it can be applied to assembled cases and  
4 hulls, either before or after loading and closing.

5 In an embodiment of the invention, apparatus is provided for  
6 applying indicia using inkjet printing on an external surface of cylindrical  
7 ammunition having an axis. The apparatus comprises a plurality of inkjet print  
8 heads for spraying preprogrammed indicia on the ammunition, a conveyor having  
9 means for rotatably carrying a plurality of cylindrical ammunition thereon the  
10 ammunition being rotated about the ammunition's axis while traversing the  
11 plurality of inkjet print heads for printing the preprogrammed indicia thereabout  
12 and a controller for causing the pre-programmed indicia to be sprayed on the  
13 ammunition as the ammunition is rotated.

14 Preferably, the means for rotatably carrying the ammunition on the  
15 conveyor is a plurality of spindles which are attached to bases rotatably  
16 connected to the conveyor belt. The bases may be rotated by a drive belt  
17 situated adjacent the conveyor belt and which engages the base. The drive belt  
18 is driven in a direction opposite to that of the conveyor to cause rotation the the  
19 bases and spindles. Alternatively, the bases may be geared pinions which  
20 engage teeth in a rack positioned adjacent the conveyor belt, the ratio of the  
21 teeth and the gears causing the bases and spindles to rotate.

22 Alternatively, in the case of pre-manufactured ammunition, the  
23 means for engaging the ammunition to the conveyor may be gripper means.

1 magnetic means or sandwiching means, all connected rotatably to the conveyor  
2 for rotating the ammunition as it passes a plurality of inkjet print heads

3           The inkjet print heads are positioned adjacent the conveyor and are  
4 controlled by the controller, such as a computer, to spray the indicia onto the  
5 rotating ammunition. Typically, at least three inkjet print heads, one for yellow,  
6 one for cyan and one for magenta, are required to complete the camouflage  
7 pattern. Preferably, UV curable ink is used and a UV source is housed along the  
8 conveyor for curing the ink onto the ammunition once it has passed the print  
9 heads. Alternatively, the ammunition is pre-treated using a corona treatment  
10 which enhances adhesion to the surface of the ammunition prior to printing using  
11 solvent-based inks which do not require curing. Ammunition is removed from the  
12 conveyor and is directed to be loaded or closed and then packaged, or in the  
13 case of pre-manufactured ammunition is directed for packaging.

14

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiments of the invention are described herein relative to a shotshell, however, one skilled in the art would understand that the invention may be applied to other cylindrical ammunition, shell casings, munitions and the like, which may require indicia to be printed on the surface and, more particularly, a camouflage pattern printed on a substantial portion of the exterior surface.

A prior art shotshell 1, as shown in Fig. 1, has a reflective metal hull 2 and typically, a colored plastic case 3. Shotshells of this type are problematic due to glare which scares away waterfowl, especially when the shotshells 1 are present in large quantities, such as outside a hunting blind.

In an embodiment of the invention, as shown in Figs. 2-4, an outside surface 10 of the shotshell 11 is covered or imprinted with indicia that reduces the glare from the case 3 and/or hull 2 and allows it to be camouflaged in a particular environment. A number of different camouflage patterns, including registered, copyrighted patterns such as Camo-shell™ (US VAu 592-548), incorporated herein by reference, or similar indicia, may be used on the outer surface 10 of the shotshell 1 to permit the camouflaged shotshell 11 to be hidden in a wetland marsh, stubble fields, snow covered fields or other waterfowl environments (Fig. 4).

The pattern is imparted to the outer surface 10 of the shotshell 1 in such a manner so as to make the indicia relatively permanent and not easily removed by wear and tear. Techniques are employed that result in a reliable,

1 non-smearing printing of the pattern onto the surfaces 10 of both the typically  
2 metal hull 2 and the plastic or paper of the case 3.

3 Further, the addition of the printing or film to the outside surface 10  
4 of the shotshell 1 is sufficiently thin so as to avoid changing a diameter of the  
5 printed shotshell 11 significantly, permitting fit within allowable tolerances within a  
6 gun breach and does not affect the firing surface of the shotshell 11.

7 As shown in Figs. 5a and 5b, the printing process can be  
8 incorporated at different stages of the manufacturing process. The addition of the  
9 camouflage indicia to the outer surface 10 of the shotshell 1 can be performed as  
10 an integral part of the shotshell 1 manufacture by incorporation of a printing  
11 module into the production stream of existing automated shotshell manufacturing  
12 processes. Printing may be done immediately prior to a packaging portion of the  
13 process or, more preferably, prior to loading the assembled case 3 and hull 2.

14 Having reference to Fig. 5a, indicia is imparted separately to the  
15 hull 2 and case 3 prior to assembly, loading and packaging. In Fig. 5b, the hull 2  
16 and case 3 are assembled in a first step. Two alternate processes are shown,  
17 one in which the assembled shotshells 1 are first printed and then loaded and a  
18 second wherein the assembled shotshells 1 are first loaded and then printed. In  
19 both cases the final step is packaging of the camouflaged shotshells 11.

20 Alternatively, pre-manufactured and packaged shotshells 1 can be  
21 unpackaged and added to a standalone printing module to allow the already  
22 manufactured shotshells 1 to be camouflaged in a post-production operation. A  
23 re-packaging process is typically added following printing.

1            Optionally, indicia added to the outer surface 10 of a shotshell 1  
2   can include already known camouflage patterns, newly designed patterns  
3   customized for specific environments and may also include logos or other  
4   information of interest to the hunter.

5            In an embodiment of the invention, as outlined in Fig. 6, the entire  
6   outer surface 10 of the shotshell 1, including the case 3 and the hull 2, is sprayed  
7   using an inkjet printer head or a plurality of inkjet printer heads 20 for applying  
8   indicia, such as a camouflage pattern, to a substantial portion of the external  
9   surface 21 of the shotshell 1.

10           Having reference to Fig. 7, apparatus 30 is provided for  
11   incorporating the printing method using inkjet printer heads 20 into a typical  
12   shotshell 1 manufacturing stream. Following assembly of the cases 3 and hulls 2,  
13   the shotshells 1 are directed towards a conveyor 31 which picks up the  
14   assembled shotshells 1 and conveys the shotshells 1 for printing.

15           The conveyor 31 preferably consists of a plurality of individual  
16   spindles 32 rotatably connected to a conveyor belt 33 and protruding outwards  
17   therefrom. The shotshells 1 are oriented prior to reaching the conveyor 31,  
18   having an open end 34 of each shotshell 1 directed toward the conveyor 31.  
19   Typically, a hull orientor or bowl feeder 35 is used to orient the shotshells 1 in the  
20   desired direction. An electric eye 36 positioned adjacent an exit 37 from the hull  
21   orientor 35 ensures that the open end 34 of the shotshell case 3 is aligned with  
22   an individual spindle 32. When the case 3 and spindle 32 are aligned, an air jet  
23   38 is released against the closed hull end 2 of the shotshell 1 to shoot the

1 shotshell 1 onto the spindle 32. Each spindle 32 extends from a spindle base 39  
2 which is rotatably attached to a conveyor 31. Rotation of the circular base  
3 member 39 and spindle 32 causes the attached shotshell 1 to co-rotate about an  
4 axis.

5            Preferably, a distal end 40 of each spindle 32 further comprises a  
6 magnet 41 which attracts the metal hull end 2 of the shotshell 1 causing the  
7 shotshell 1 to be held firmly to the spindle 32 as it is conveyed and rotated along  
8 the conveyor 31. The ratio of the speed of rotation of the spindle 32 and the  
9 conveyor belt 31 is such that the shotshell 1 is caused to rotate 360° about its  
10 axis and within a spray pattern from each of a plurality of inkjet printer heads 20  
11 which are positioned adjacent the conveyor 31. As the shotshell 1 is rotated in  
12 front of the printer heads 20, a controller 42 causes each inkjet printer head 20 to  
13 spray pre-programmed indicia, such as a camouflage pattern or a portion of a  
14 camouflage pattern, onto the entire outer surface of the shotshell 1. Typically,  
15 three inkjet printer heads 20 are used to impart the camouflage pattern to the  
16 shotshell 1. The three printer heads 20 typically comprise a first which prints in  
17 yellow, a second which prints in cyan and a third which prints in magenta. Some  
18 camouflage patterns may require a fourth printer head which typically prints in  
19 black.

20            The controller 42, such as a computer, is used to control the spray  
21 pattern from each of the inkjet printer heads 20 using conventional print controller  
22 technology and a specific program containing the desired pattern co-ordinates.

1 Further, the controller 42 is programmed to co-ordinate the speed of the  
2 conveyor 31 and the speed of rotation of the spindles 32.

3 Preferably, ink used in the inkjet printer heads 20 is a UV-curable  
4 ink. The resulting indicia printed onto the shotshells 1 is durable and not easily  
5 removed or abraded from the surface. Following spraying of the pattern onto the  
6 shotshell 1, the shotshell 1 is conveyed to a UV source 50 positioned inside a  
7 housing or curing tunnel 51 where the source of UV light 50 is directed to the  
8 external surface of the shotshell 1 for curing the ink thereon.

9 Following curing, the conveyor 31 transports the printed shotshells  
10 11 to an exit 52 where the shotshells 11 are removed from the conveyor 31 and  
11 are incorporated into conventional loading and packaging apparatus.

12 Preferably, the spindle 32 further comprises a port 53 which  
13 extends through the spindle 32. As the spindle 32 reaches the exit 52, the port 53  
14 in the spindle 32 is aligned with a jet of pressurized air 54. A mechanical valve 55  
15 is caused to open, releasing the jet of air 54 through the port 53 in the spindle 32.  
16 The jet of pressurized air 54 overcomes the attraction of the magnet 41, causing  
17 the printed shotshell 11 to fall from the spindle 32 and into a bowl feeder (not  
18 shown) from which the printed shotshells 11 are fed to the conventional loading  
19 and packaging processes.

20 Alternatively, as shown in dotted lines in Fig. 7, a corona treatment  
21 unit 56, is positioned in advance of the ink jet print heads. The shotshells 1  
22 receive the corona treatment according to conventional technology to improve  
23 adhesion to the surface of the shotshells 1 prior to being conveyed and rotated

1 past the ink jet print heads 20. A solvent-based ink is used to spray the indicia  
2 onto the shotshells 1 as previously described and the shotshells 1 are then  
3 directed to conventional loading and closing apparatus without the need to  
4 undergo a curing process.

5 As shown in greater detail in Figs. 8 and 9 and in a preferred  
6 embodiment of the invention, a pair of corresponding rotating belts 70,71 is  
7 situated adjacent the print heads 20. One of the belts 70,71 is a drive belt 70 and  
8 the other is an idler belt 71. The belts 70,71 are positioned, one on either side of  
9 the conveyor belt 33 and are spaced so as to engage the spindle bases 39  
10 therebetween as the conveyor 31 causes the spindles 32 and shotshells 1 to be  
11 conveyed to the print heads 20. The drive belt 70 is driven in an opposite  
12 direction to the conveyor belt 33 so as to cause each spindle base 39, spindle 32  
13 and attached shotshell 1 to co-rotate therebetween. The idler belt 71 ensures  
14 that the spindle base 39 remains in contact with the drive belt 70 at all times. The  
15 speed of the drive belt 70 relative to the speed of the conveyor 31 is adjusted to  
16 cause the shotshell 1 to be rotated at least a full 360° at the print heads 20.

17 In another embodiment, as shown in Figs. 10a-10c, the shotshells 1  
18 are moved from the hull orientor 35 onto spindles 32 having geared bases or  
19 pinions 80. The pinions 80 engage a toothed rack 81 which acts to rotate the  
20 pinions 80 as they are conveyed by the continuous conveyor belt 33 to the printer  
21 heads 20 and to the curing tunnel 51. The ratio of the teeth in the rack 81 and  
22 teeth on the pinions 80 causes the spindles 32 and attached shotshells 1 to

1 rotate at least a full 360° at the print heads 20, permitting printed about the entire  
2 outer surface 10 of the shotshells 1.

3 As shown in Fig. 10b, the hull orientor 35 is positioned below the  
4 curing tunnel 51. A timing screw 82 acts to align the shotshells 1 with the  
5 spindles 32 as the conveyor belt 33 moves from the hull orientor 35 to the print  
6 heads 20 positioned above. The shotshells 1 are retained on the spindles using  
7 magnets 41 and are ejected from the spindles 32 using the air jet 54, as  
8 previously described.

9 In an additional embodiment, the round bottom of the hull 2 is also  
10 sprayed, such as with a flat, non-glare ink.

11 In the case of preloaded ammunition, such as shotshells 1, means  
12 are provided in place of the spindles 32 to engage and rotate the shotshells 1.  
13 The means for engaging the loaded shotshell 1 may include such apparatus as  
14 means for gripping the shotshell 1, particularly at a base of the hull 2, magnetic  
15 means for attracting the metallic hull 2 to a rotatable base connected to the  
16 conveyor belt or means for sandwiching the shotshell therebetween and rotating  
17 the shotshell 1 for printing.

18 As outlined in Fig. 11 and shown in Fig. 12 and in yet another  
19 alternate embodiment of the method of the invention, the camouflage pattern is  
20 imparted to the shotshell 1 using pre-printed heat transfer sleeves 100.

21 Heat shrinking film technology is known and is currently used for  
22 processing the surface of cylindrical objects such as soda cans and the like, as  
23 disclosed in PCT application WO 00689992 to Sukeyasu et al. and WO

1 00017316 to Thawley et al. and incorporated herein by reference. Preprinted  
2 sleeves are placed over the cylindrical object and the film is then heated to cause  
3 shrinking of the film onto the surface of the object. Printing of the sleeve,  
4 preferably using a camouflage pattern, may be incorporated into the process or  
5 can be separately performed prior to heat shrinking.

6 As shown in Figs. 12a-12c, the thin film sleeve 100, to which the  
7 indicia has been imparted using fast drying and permanent ink, is placed over at  
8 least a portion of the case 3 and possibly, the hull 2. Preferably, at least one  
9 inkjet-type spray head is used to impart a non-glare, rapid drying ink to portions  
10 of the case 3 and/or hull 2 that are not covered by the sleeve 100. Sufficient heat  
11 (Fig. 12b) is applied to the sleeve 100 using established prior art techniques to  
12 cause the sleeve 100 to shrink and bond to the outer surface 10 of the shotshell  
13 1. The temperature is monitored to ensure that the heat does not create a safety  
14 hazard with the explosive material in the shotshell 1 or other ammunition.

15 The sleeve 100 extends above a top 105 of the case 3 such that  
16 when the sleeve is heat-shrunk, the sleeve 100 shrinks and seals over the top  
17 105 of the shotshell 1 adding additional water resistance or waterproofing to the  
18 shotshell 1. The remainder of the hull 2 is then sprayed with the rapid drying ink  
19 using the inkjet process to provide a non-reflective surface over the hull 2.  
20 Preferably, a bottom 103 of the hull 2 is also sprayed to reduce glare therefrom.  
21 More preferably, the sleeve 100 covers the entire case 3 and hull 2 to a rim 102  
22 formed at the base of the hull 2.

1                    In the case of shotshells 1 of varying lengths, optionally sleeves  
2 100 of varying lengths are produced to cover the entire outer surface of the  
3 shotshells 1 or a single sleeve length is produced and applied to a portion of the  
4 case 3 only. The remainder of the surface, being typically the hull 2, but possibly  
5 including a portion of the case 3 for longer shotshell lengths, is sprayed using the  
6 inkjet process.